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The Mediating effect of Business Intelligence Systems on the relationship between Supply Chain Management and Customer Relationship Management

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ABSTRACT The purpose of this study is to investigate the impact of the effect of Supply Chain Management in Customer Relationship Management: The mediating role of Business Intelligence Systems. Data was collected using a survey method, the survey targeted professionals in the field of supply chain management and Business Intelligence Systems. Whereby a total of 300 questionnaires were distributed to the study sample, (270 useable questionnaires returned). Structural model assessment was conducted to test the relationships among Supply Chain Management, Business Intelligence Systems, Customer Relationship Management the results show a positive relationship between Supply Chain Management dimensions and Customer Relationship Management. Moreover, Business Intelligence Systems play a mediating role in the relationship between Supply Chain Management and the Customer Relationship Management.

KEYWORDS: Supply Chain Management, Customer Relationship Management, Business Intelligence Systems

1. INTRODUCTION

In a time of digital revolution, where ever-improving technology is changing our lives on a daily basis, the importance of data use cannot be emphasized. The increasing amounts of data being produced demand skilled management and examination in order to derive significant understanding (Namvar et al., 2016). As a result, businesses are faced with managing enormous datasets throughout their whole operations. As a result, they look for software programs and knowledgeable employees that can use various data sources to help with well-informed decision-making. Presently, Business Intelligence (BI), an idea designed to facilitate the gathering, processing, and application of data. According to Watson and Wixom (2007), BI becomes a crucial enabler that improves organizational value and performance. According to Namvar et al. (2016), business intelligence (BI) is the process of providing management with the means to extract meaningful business data, which in turn enables management to make well-informed decisions. BI, which is frequently used as a "umbrella" phrase,

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encompasses a number of data analysis aspects, including big data, business analytics, data warehousing, and data mining (Trieu, 2017). Showcase BI as a complex system that combines elements of technology, process, and/or product.

Supply chain management, or SCM, is a fundamental component of all business sectors, from startups to large conglomerates. SCM is essentially about coordinating people, resources, and procedures to maximize value delivery from suppliers to consumers while keeping costs to a minimum. Supply chain management (SCM) is the process of delivering goods or services from suppliers to end users through a network of individuals, organizations, information, and resources (Kaina & Verma, 2018). Many stakeholders from different departments are included in this network, which guarantees the smooth integration of logistics management, transformation, and procurement processes (Ellram et al., 2019).

SCM is a cooperative effort that, in order to improve long-term performance, requires cooperation across many businesses and business processes. By combining marketing, sales, R&D, production, procurement, logistics, IT, finance, and customer support, SCM goes beyond conventional corporate operations. SCM operates as a pipeline, optimizing the flows of information, financial resources, goods, and services to maximize customer value and satisfaction—a critical component of profitability and competitive advantage. Specifically, SCM prioritizes efficiency and meets the expectations of customers at every level of the organization (Martins & Pato, 2019; Chopra & Meindl, 2013).

Differentiating SCM from traditional logistics, the former involves an interconnected network of different parties that work together to deliver items to market, while the latter is more concerned with internal operations within a company. While SCM expands the scope of logistics by promoting connections and coordination between suppliers, consumers, and the organization itself, logistics mostly focuses on organizing product and information flows within a firm Thus, SCM embraces interdepartmental cooperation throughout operations, going beyond simple logistical activities Mukhamedjanova, 2020).

Simultaneously, client Relationship Management (CRM) presents itself as a comprehensive approach intended to recognize, procure, oversee, and cultivate promising client connections. CRM strengthens long-term relationships with customers by utilizing information technology, which increases customer satisfaction and retention. CRM plays a crucial role in adjusting to changing customer expectations in a time of more customization and personalized service, which promotes sustainability and loyalty. The Gil-Gomez group (2020). The incorporation of CRM into supply chain management and decision-making procedures results in significant advantages that improve customer satisfaction and organizational effectiveness CRM is even more important in the value chain because of its emphasis on sustainable business model innovation and digital focus, which are in line with modern green IT concepts (Guerola-Navarro et al., 2021; Chatterjee et al., 2022).

Given these interrelated domains of business intelligence, supply chain management, and customer relationship management, the mediating role of business intelligence systems on the interaction between these two critical functions becomes apparent and calls for more investigation and research. In order to better understand the complex interactions between these domains and the transformative potential of business intelligence (BI) in enhancing SCM-CRM dynamics for organizational performance in the digital age, this study aims to delve into this nexus.

2. LITERATURE REVIEW

2.1. Theoretical framework

Business Intelligence (BI) systems have become indispensable tools across various enterprises, particularly within logistics operations. These systems facilitate a myriad of analyses, making them particularly valuable in dynamic supply chain environments where swift decision-making is paramount. Accuracy in data extraction and analysis is crucial for informed decision-making, especially amidst rapidly changing scenarios (Tan, Leeb Goh, 2012). BI systems play a pivotal role in mitigating costs associated with reverse logistics, which involves managing the flow of products designated for remanufacturing, recycling, or disposal. By efficiently handling product returns due to factors like seasonality, quality issues, expiration, or transit damage, enterprises can elevate customer service and retention levels (Senthil, Srirangacharyulu, Ramesh, 2012).

In the realm of supply chain management, BI offers numerous benefits, including cost-effective transportation, streamlined logistics operations, enhanced customer service through route optimization, thorough analysis of transport operations, cargo load optimization, and efficient inventory and order management (Vatovec Krmac, 2011). Moreover, BI empowers decision-makers by providing insights into market trends and their impact on business operations, facilitated through dashboards and scoreboards that highlight key performance indicators (KPIs) and operational exceptions. Sahay emphasizes the critical role of BI in enhancing the effectiveness and efficiency of supply chain analytics, thereby bolstering a company's competitive edge (Sahay, 2013). One significant application of BI in logistics lies in the optimization of transportation and distribution activities, leading to reduced distribution costs and the identification of optimal solutions for complex optimization problems through advanced data mining techniques (Olszak, Ziemba, 2012).

Furthermore, the integration of BI with Radio Frequency Identification (RFID) technology holds promise for optimizing supply chain operations. Baars et al. assert that RFID-based automatic identification systems are poised to drive substantial improvements in cost efficiency within transportation and warehousing processes (Baars et al., 2008). This synergy between BI and RFID technology opens avenues for heightened efficiency and cost savings across the logistics spectrum.

2.2 Empirical review

Olexova (2014) asserts that a company's ability to successfully integrate business intelligence (BI) increases managerial value and makes it easier to optimize business operations. Another notable case study by Presthus and Canales (2015) centers on the deployment of business intelligence dashboards at WWL Logistics Company, a significant operator in international shipping and logistics for different manufacturers. According to this report, WWL's Global Procurement department created seven Key Performance Indicators (KPIs) in 2012, each of which included a set of improvement objectives meant to improve operational procedures and strategic supplier relationships. Moreover, CF Industries, the second-largest nitrogen producer in the world, is the subject of another case study that demonstrates the use of BI in the supply chain environment. With the task of converting their antiquated systems to SAP in hand, CF Industries turned to Globonix's supply chain and logistics know-how. With the help of Globonix's BI solutions, CF Industries was able to carry out several system integrations at once, which led to significant cost savings and the prompt installation of an effective operational framework Globonix, (2018).

Additionally, Williams (2007) explains how a computer hard disk drive manufacturer used business intelligence (BI) to manage product lifecycles, improve customer relations, optimize inventory management, and streamline supply chains. The company's running costs were remarkably reduced by 50% as a result of this smart use of BI. When taken as a whole, these case studies demonstrate the broad range of applications that BI systems can have in the logistics industry and how well they work to improve overall business performance, cost savings, and operational efficiency.

Grabińska and Ziora (2019) want to demonstrate the useful application of business intelligence (BI) systems in the logistics sector, with a focus on how important they are for aiding in decision-making. They highlight the numerous benefits of business intelligence (BI) for logistics firms and emphasize how crucial it is for supporting decision-making in a variety of supply chain contexts.

Šerić, Rozga, and Luetić (2014) go into great detail to explain the relationship between supply chain management and business intelligence, with a special emphasis on marketing decision-making. Their research finds a significant statistical relationship between supply chain management, information visibility, business intelligence, and partner integration in the production chain. A conceptual analysis of the supply chain's influence on business intelligence (BI) in privately held companies is provided by Langlois and Chauvel (2017). Trieu, V.-H. (2017). the purpose of the study is to determine which aspects of the BI business value process have already been investigated and which ones require further investigation. It also suggests particular research questions for the future. According to Soh and Markus's (1995) process, which consists of a series of necessary conditions ranging from BI investments to BI assets to BI impacts to organizational performance, the results indicate that organizations seem to derive value from BI systems. Nevertheless, the probabilistic processes that connect these necessary conditions have not received enough attention from researchers. Their study emphasizes how the supply chain creates a multitude of data points, from first suppliers to final consumers, and how important it is for businesses to carefully examine this data in order to maximize operational effectiveness.

Cheng, J et al., (2023). In light of the moderating role of green knowledge management, this research attempts to investigate the factors that influence sustainability performance in manufacturing organizations as well as the influence of business intelligence and big data analytics capabilities on performance. The findings showed that business intelligence is a key determinant of big data analytics competence, and sustainability performance is a benefit of big data analytics capability. Green knowledge management does not moderate the association between big data analytics capability and sustainability performance; instead, big data analytics capability mediates the positive relationship between business intelligence and sustainability performance.

By conducting a thorough examination of recent literature Tozin (2022) hopes to clarify the meanings of Supply Chain Management (SCM) and Business Intelligence (BI), as well as outline the benefits and challenges of integrating BI systems into SCM frameworks. From their research, they find that combining these two ideas can provide organizations with significant competitive advantages. The aforementioned benefits stem from the functionalities of business intelligence (BI) applications in supply chain management (SCM) contexts. These functionalities include the capacity to display real-time data via intuitive visualization tools, precise demand and production forecasting, distribution route and warehouse management optimization, execution of predictive analyses to minimize disruptions, and numerous other advantages.

The study conducted by Sengun et al., (2019) examined the relationship between supply chain competencies, innovativeness, and IT resources in relation to business performance. Their findings highlight the growing importance of IT resources and investments in the current, highly digitalized supply chain environment.

3. CONCEPTUAL FRAMEWORK

The conceptual framework (supply chain management, customer relationship management, and business intelligence systems) for the creation of hypotheses in this study can be explained in Figure 1 based on other studies.

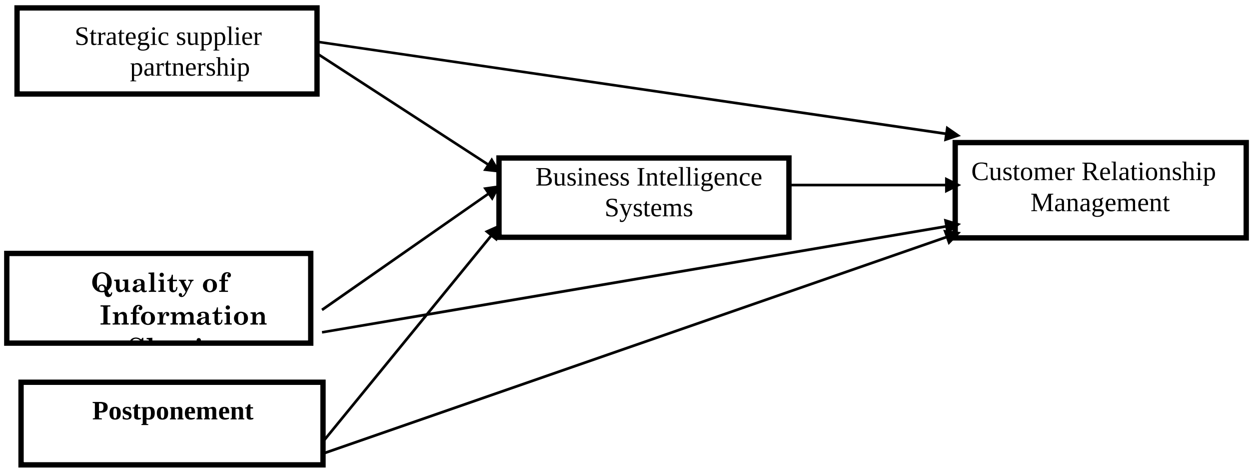

Figure 1. Conceptual Framework of Hypothesis Formation

H1. Strategic supplier partnership has a significant influence on Business Intelligence Systems.
H2. Strategic supplier partnership has a significant influence on Customer Relationship Management.
H3. Quality of Information Sharing has a significant influence on Business Intelligence Systems.
H4. Quality of Information Sharing has a significant influence on Customer Relationship Management.
H5. Postponement has a significant influence on Business Intelligence Systems.
H6. Postponement has a significant influence on Customer Relationship Management.
H7. Business Intelligence Systems has a significant influence on Customer Relationship Management.

4. METHODOLOGY

To put it briefly, the research design creates a broad framework for how the study will be conducted and how the research questions will be addressed. Quantitative research is the most effective way to explain the correlations between observable variables (Leedy & Ormrod, 2005). This study uses a cross-sectional survey method in conjunction with a quantitative approach since it is more acceptable to use quantitative methods when the conceptual model that is developed calls for a larger sample size to be investigated. The cross-sectional survey approach was selected due to its ability to collect more data at a lesser cost from a wider demographic. Moreover, there's a chance that the methodology used for the poll will yield results that are typical of the entire population. It was imperative to gather information.

The effect of supply chain management on customer relationship management: the mediating role of business intelligence systems is the aim of the current study. Additionally, to test the study hypotheses using a positivist-related quantitative technique. The study used a survey questionnaire to professionals who work on the networking site LinkedIn in the fields of supply chain management, logistics, and business intelligence systems. The study model and hypotheses that were suggested were tested using PLS statistical techniques. The study employed a cross-sectional approach to achieve its objectives.

The primary methods of data collecting for this study were a quantitative approach using a survey questionnaire as a research tool, with careful consideration given to the random sampling strategy applied to the target population. Relevant statistical analyses, including using SPSS, data normalcy and measures, and analysis PLS, were used in this study. With the aid of this program, the mediating analysis verifies the validity and the measurement model.

4.1 Research Population and Sample

In order to collect data in the Researchers distributed an online survey using the professional networking site LinkedIn. Professionals working in supply chain management, logistics, and business intelligence systems were the target audience for the poll. Three hundred people finished the survey. A review of the participants' LinkedIn profiles showed a wide variety of experiences, with people having held a variety of positions and responsibilities over the course of their careers. Furthermore, the majority of participants (62) percent reported that their greatest educational achievement was a bachelor's degree. Moreover, the majority of the sample, 48.2% of participants, reported having five to ten years of job experience. Out of the 300 responders, men made up (59.2%) of the participants, while women made up (40.8%). In addition, (64.0%) of the respondents belonged to the (32–37) age range.

5. DATA ANALYSIS METHOD

Because the data were not normally distributed, partial least squares structural equation modeling (PLS-SEM, 3.1) was used in this study to test the research model. Path models with latent constructs are assessed using PLS-SEM, a multivariate analysis method (Hair et al., 2019). The path effect from exogenous construct to endogenous construct is described by the effect size f2, which is used in model estimation (Hair et al., 2019).

5.1 Results and Discussion

Measurement model assessment

Assess the instrument's quality for this study using Smart PLS. The validity test includes a measurement of the instrument's quality. A validity examination of the questions is necessary as prior research has shown that all indicators are suitable for use as research tools. An indication is deemed valid if the significance value of each question item is less than 0.05. That's why this study will only take into account question items that have a significance value of less than 0.05. Indicators for delay, quality of information sharing, business intelligence systems, customer relationship management, and strategic supplier alliances were all employed in this study, and all of them had significant values of less than 5% or less than 0.05. Based on each question item's validity test. Such that each indicator that utilizes this research is thought to be a reliable and valid way to measure data that can then be investigated. This study's cross-loading values all pass the discriminant validity test, showing a value greater than 0.07. In order to ensure that every latent variable is unique from the others, discriminant validity is employed.

Table 1. Validity and Reliability

Variable	Cronbach's Alpha	Rho_A	Reliabilit y Composite	Average Variant Extracted
Business Intelligence Systems	0.911	0.900	0.930	0.769
Strategic supplier partnership	0.784	0.787	0.874	0.698
Quality of Information Sharing	0.942	0.966	0.974	0.881
Postponement	0.924	0.945	0.964	0.900
Customer Relationship Management	0.892	0.891	0.948	0.902

Table 1 above explains that the validity of the aforementioned items is indicated by the composite reliability value being greater than the average variance retrieved or the reliability value based on a significance test of 0.05. On the other hand, the reliability coefficient value is a numerical value that is determined by the high and low reliability. A high degree of reliability suggests that the value is near to 1. Utilizing the Cronbach's alpha calculation to assess the instrument's reliability. Because the study tool is a questionnaire with a stratified scale. While an alpha value > 0.08 indicates that all items are consistently dependable and that all tests have excellent reliability, an alpha value > 0.7 indicates that the reliability is sufficient (sufficient reliability). It can be explained for each variable as follows, based on the explanation given before.

The four question items that make up the Strategic supplier partnership have a Cronbach's alpha coefficient of 0.784, indicating that the variable or item is valid and trustworthy. The five question items that made up the Quality of Information Sharing had a Cronbach's alpha coefficient of 0.942, indicating that the variable or item is valid and reliable.

Four question items are used to measure Postponement, and the variable's Cronbach's alpha coefficient is 0.924%, indicating that it is a valid and reliable measure. There are four question items in the Business Intelligence Systems variable, and its cronbach's alpha coefficient is 0.911, indicating that the variable or item is valid and dependable. Lastly, the Customer Relationship Management variable comprises three question items. Its cronbach's alpha coefficient is 0.892, indicating that the variable or item is valid and reliable.

5.2 Data Analysis Text

The coefficient determinant test (R-Square) is used to measure how far the model explains the dependent variable. The following are the results of the coefficient determinant test in table 2.

Table 2. Determination Test Results

	R Square	Adjusted R Square
Business Intelligence Systems	0.673	0.663
Customer Relationship Management	0.74	0.750

Table 2 above shows that the business intelligence systems result is 0,663. This indicates that the quality of information sharing, postponement, and strategic supplier partnership have a 65, 1% influence on business intelligence systems, with other variables accounting for the remaining 34.9% of the influence.

Additionally, as can be seen from the above table, the results for Customer Relationship Management are obtained by the number 0,740. This indicates that 74% of the influence on Customer Relationship Management is attributed to the independent variables (Strategic supplier partnership, Quality of Information Sharing, and Postponement), with the remaining 26% being influenced by variables not covered in this study.

5.3 Hypothesis Test

This study uses multiple regression analysis methods to test the hypothesis. Theresults of hypothesis testing can be seen in table 3 & 4.

Table 3. Path Coefficient

	Original Sample (O)	Sample Average (M)	Standard Deviation (STDEV)	T Statistik (|O/STDEV|)	P Values
S → B	0.380	0.379	0.096	4.028	0.000
S → C	0.169	0.170	0.079	2.159	0.031
Q → B	0.247	0.256	0.091	2.763	0.006
Q → C	0.317	0.319	0.086	3.701	0.000
P → B	0.318	0.314	0.076	4.217	0.000
P → C	0.253	0.253	0.091	2.797	0.005
B → C	0.266	0.264	0.088	3.019	0.003

(S - Strategic supplier partnership, Q - Quality of Information Sharing, P-Postponement, B- Business Intelligence Systems, C- Customer Relationship Management).

Table 4. Hypothesis Test Result

Hypothesis	Coefficient	P Values	Conclusion
H1	0.380	0.000	Positive and significant
H2	0.169	0.031	Positive and significant
H3	0.247	0.006	Positive and significant
H4	0.317	0.000	Positive and significant
H5	0.318	0.000	Positive and significant
H6	0.253	0.005	Positive and significant
H7	0.266	0.003	Positive and significant

A number of Result were derived from the tables 3 and 4 above. According to the first hypothesis, Strategic supplier partnership has a significant influence on Business Intelligence Systems. The results of the hypothesis test are displayed in the table, and the coefficient value of (0,380) and the significance value of (0,000) indicate that the value is less than (0,05). According to the second hypothesis, Strategic supplier partnership has a significant influence on Customer Relationship Management. The results of the hypothesis test are displayed in the table, and the coefficient value of (0,169) and the significance value of (0,031) indicate that the value is less than (0,05).

Quality of Information Sharing has a significant influence on Business Intelligence Systems is illustrated by the third hypothesis. The hypothesis test results are shown in the table. The value is less than (0.05), as indicated by the coefficient value of (0,247) and significance value of 0,006. The fourth hypothesis holds that Quality of Information Sharing has a significant influence on Customer Relationship Management. The table presents the hypothesis test findings. A significance value of 0.000 and a coefficient value of (0,317) show that the value is less than (0.05).

The fifth hypothesis states that Postponement has a significant influence has a Business Intelligence Systems. The hypothesis test results are shown in the table, and the value is less than 0.05, as indicated by the coefficient value of 0,318 and significance value of 0,000. The sixth hypothesis states that Postponement has a significant influence has a Customer Relationship Management. The table presents the hypothesis test findings. A significance value of 0,005 and a coefficient value of 0,253 show that the value is less than 0.05.

The last hypothesis demonstrates that Business Intelligence Systems has a significant influence on Customer Relationship. The results of the hypothesis test are displayed in the table, and the coefficient value of (0,268) with a significance value of (0,003) indicates that the value is less than (0,05).

Table 5. Specific Indirect Effect Test

Hypothesis	Original Sample (O)	Sample Average (M)	Standard Deviation (STDEV)	T Statistik (|O/STDEV|)	P Values
S → B → C	0.085	0.082	0.034	2.487	0.014
Q → B → C	0.067	0.067	0.034	1.970	0.049
P → B → C	0.102	0.099	0.043	2.349	0.018

The outcomes of the indirect effect test through the mediation test are as follows. The Business Intelligence Systems of the as a Mediator on the Effect of Postponement, Quality of Information Sharing, and Strategic Supplier Partnership on Customer

Relationship Management is the indirect effect test.

The outcome of the strategic supplier partnership's indirect impact on business intelligence systems and customer relationship management is as follows. It is evident from table 5 above that the estimation findings contain multiple p-values (0,014) indicating an indirect influence. The indirect impact that business intelligence systems' perception of information sharing quality has on customer relationship management. It is evident from table 5 above that the estimation findings contain multiple p-values (0,049) indicating an indirect influence. Whereas the outcomes of the indirect impact of the delay on customer relationship management through business intelligence systems. The estimated indirect effect of the p-value (0,018) can be found in table 5 above. The study's findings support the notion that business intelligence systems, postponement, quality of information sharing, and strategic supplier partnerships all have an impact on customer relationship management.

6. CONCLUSION

This study investigates the impact of the effect of Supply Chain Management in Customer Relationship Management: The mediating role of Business Intelligence Systems within the logistics domain. The hypotheses proposed are tested through regression analysis, revealing significant coefficients and p-values. Results suggest that BI systems benefit from strategic supplier partnerships and quality information sharing, while customer relationship management benefits from BI systems, postponement strategies, and quality information sharing. Furthermore, indirect effects analyses indicate the influence of strategic supplier partnerships, information sharing quality, and postponement on customer relationship management through BI systems.

These results are corroborated by earlier research, which highlights the critical role that business intelligence (BI) plays in improving logistics operations, cost reduction, and decision-making. Literature also emphasizes the relationship between supply chain management (SCM) and business intelligence (BI), emphasizing the benefits of BI integration in SCM systems, including real-time data visualization, demand forecasting, and predictive analytics. Research findings further emphasize how crucial Information Technology (IT) resources are for fostering innovation and strengthening supply chain competencies, which in turn improves overall business performance.

In conclusion, this study contributes to understanding the multifaceted impacts of BI systems and strategic partnerships on customer relationship management in logistics. It underscores the significance of leveraging BI within SCM frameworks to achieve competitive advantages and optimize business performance in today's digitalized supply chain landscape.

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